

Amendment and Response
Applicant: Krasulick, et al.
Serial No.: 10/005,065
Page 12 of 18

REMARKS

Amendments to the Specification and the Abstract

Paragraphs [0007]-[0009], [0016]-[0017], [0019], [0023], and [0026] and the Abstract have been amended to correct a typographical error. The word "though" has been amended in these paragraphs and the Abstract to recite the word "through."

Pending Claims:

Claims 1-33 are currently pending in the present application. Claims 1, 4-9, 11, 13-14, 23-24, 28-31, and 32 are amended by the present Amendment. Claim 33 is added by the present Amendment. Applicants submit that no new matter is added by these amendments and by new claim 33. Upon entry of the present Amendment, reconsideration of claims 1-32 and consideration of new claim 33 is respectfully requested.

Rejections under 35 U.S.C. §112:

Claims 14, 24, 30-32 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as the invention.

The Office Action states that claim 14 recites the limitation "the electro-absorption modulation" in line 2 and that there is insufficient antecedent basis for this limitation in the claim. Claim 14 has been amended to recite "the electro-absorption modulator" as suggested by the Examiner. The Applicants submit that the amendment to claim 14 overcomes the rejection under 35 U.S.C. §112.

The Office Action states that claim 24 recites the limitation "the electrical AC modulation signal" in the last line and that there is insufficient antecedent basis for this limitation in the claim. Claim 24 has been amended to recite "the AC electrical modulation signal" as suggested by the Examiner. The Applicants submit that the amendment to claim 24 overcomes the rejection under 35 U.S.C. §112.

The Office Action states that claim 30 recites the limitation "the semiconductor layers" in

Amendment and Response
Applicant: Krasulick, et al.
Serial No.: 10/005,065
Page 13 of 18

line 2 and that there is insufficient antecedent basis for this limitation in the claim. Claim 30 has been amended to recite "the semiconductor layer." The Applicants submit that the amendment to claim 30 overcomes the rejection under 35 U.S.C. §112.

The Office Action states that claim 31 recites the limitation "the semiconductor layers" in line 2 and that there is insufficient antecedent basis for this limitation in the claim. Claim 31 has been amended to recite "the semiconductor layer." The Applicants submit that the amendment to claim 31 overcomes the rejection under 35 U.S.C. §112.

The Office Action states that claim 32 recites the limitation "the electrical modulation signal" in the second to last line and that there is insufficient antecedent basis for this limitation in the claim. Claim 32 has been amended to recite "the AC electrical modulation signal" as suggested by the Examiner. The Applicants submit that the amendment to claim 32 overcomes the rejection under 35 U.S.C. §112.

Claim Objection

Claim 29 has been objected to because of a typographical error in line 6. Claim 32 has been amended to recite "through" as suggested by the Examiner. The Applicants submit that the amendment to claim 29 overcomes the claim objection.

Rejections under 35 U.S.C. §102(b):

Claims 1-32 have been rejected under 35 U.S.C. §102(b) as being anticipated by the Applicant's admitted prior art. According to the Office Action, the Applicant's admitted prior art discloses the claimed invention. Specifically, the Office Action states that paragraph [0041] of the specification teaches that prior art electro-absorption modulator are substantially transparent to light when a substantially zero bias is applied.

Paragraph [0041] describes the operation of the prior art electro-absorption modulated (EAM) laser shown in FIG. 1. Specifically, paragraph [0041] states that light emitted from the laser diode 12 that propagates to the EAM 14 can be modulated by modulating the voltage across the multi-quantum well semiconductor layer between a sufficient reverse bias voltage across the semiconductor layer that causes the layer to be substantially opaque to the light emitted from the

Amendment and Response
Applicant: Krasulick, et al.
Serial No.: 10/005,065
Page 14 of 18

laser diode 12, and substantially zero or a sufficiently positive bias voltage that causes the layer to be substantially transparent to the light emitted from the laser diode 12.

The operation of prior art EAM devices can be further explained with reference to FIG. 3 of the present application. FIG. 3 illustrates a theoretical family of normalized transmission responses as a function of applied voltage for a prior art EAM. The theoretical family of normalized transmission responses indicates that in order to achieve a particular normalized transmission level, the magnitude of the reverse bias voltage across the semiconductor layer decreases as the ambient temperature increases. At elevated temperatures (approximately 35°C and above), the theoretical family of normalized transmission responses indicates that such prior art EAMs would require a positive voltage to cause the EAM to absorb light. However, generally semiconductor EAMs cannot reliably operate with positive voltages because a reverse bias voltage is required across the semiconductor layer to move the absorption edge to a longer wavelength, which causes the EAM to absorb the light emitted from the laser diode. Therefore, the transmission responses shown in FIG. 3 indicates these prior art EAMs do not function (i.e. absorb light) at temperatures substantially greater than room temperature.

In contrast, the operation of EAM devices according to the present invention can be explained with reference to FIG. 7 of the present application. FIG. 7 illustrates a family of normalized transmission responses for a particular operating wavelength over a range of temperatures as a function of applied voltage for one embodiment of an EAM according to the present invention. An EAM material structure according to the present invention is designed so that it is effectively pre-biased compared with prior art EAM material structures so that the EAM can operate at higher operating temperatures. The family of normalized transmission responses shown in FIG. 7 indicates that the EAM material structure of this device is designed to operate with an applied reverse bias voltage through the entire operating temperature of the EAM up to the maximum temperature of 70°C.

Thus, an EAM of the present invention can be described as having a semiconductor layer with a material composition that is chosen so that a transmission response for a desired operating wavelength as a function of applied reverse bias is shifted relative to the transmission response of prior art electro-absorption modulators. The transmission response is shifted such

Amendment and Response
Applicant: Krasulick, et al.
Serial No.: 10/005,065
Page 15 of 18

that the response as a function of applied voltage changes with increasing operating temperature of the modulator so that the semiconductor layer is substantially transparent to light propagating through the semiconductor layer when a substantially zero or a reverse bias voltage is applied across the semiconductor layer at operating temperatures of the modulator that are substantially greater than 25 degrees Celsius. Independent claims 1, 13, 24, 29 and 32 have been amended to more clearly recite the invention.

Independent claim 1, as currently amended, recites an electro-absorption modulator comprising a semiconductor layer that is chosen so that a transmission response of the modulator as a function of applied voltage shifts with an increasing operating temperature of the modulator so that the semiconductor layer is substantially transparent to light propagating through the semiconductor layer when a substantially zero or a reverse bias voltage is applied across the semiconductor layer at operating temperatures of the modulator that are substantially greater than 25 degrees Celsius.

To anticipate a claim under 35 U.S.C. §102, a single reference must teach every aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught by the reference must be inherently present in the reference. Thus, a claim is anticipated by a reference only if each and every element of the claim is described, either expressly or inherently, in a single prior art reference.

Paragraph [0041] of the present specification does not teach an electro-absorption modulator with a material composition of the semiconductor layer that is chosen so that a transmission response of the modulator as a function of applied voltage shifts with an increasing operating temperature as claimed in independent claim 1. Therefore, the Applicants submit that independent claim 1 is allowable over the description of the prior art in the present specification. The Applicants also submit that dependent claims 2-12 are allowable as depending upon an allowable base claim. The Applicants further submit that new dependent claim 33 (which is dependent upon claim 1) is allowable as depending upon an allowable base claim.

Similarly, independent claim 13, as currently amended, recites an electro-absorption modulated laser comprising an electro-absorption modulator including a semiconductor layer having a material composition chosen so that a transmission response of the modulator as a

Amendment and Response
Applicant: Krasulick, et al.
Serial No.: 10/005,065
Page 16 of 18

function of applied voltage shifts with an increasing operating temperature of the modulator so that the semiconductor layer is substantially transparent to light propagating through the semiconductor layer when a substantially zero or a reverse bias voltage is applied across the semiconductor layer at operating temperatures of the electro-absorption modulator that are substantially greater than 25 degrees Celsius.

Paragraph [0041] of the present specification does not teach an electro-absorption modulated laser comprising an electro-absorption modulator including a semiconductor layer that is chosen so that a transmission response of the modulator as a function of applied voltage shifts with an increasing operating temperature as claimed in independent claim 13. Therefore, the Applicants submit that independent claim 13 is allowable over the description of the prior art in the present specification. The Applicants also submit that dependent claims 14-23 are allowable as depending upon an allowable base claim.

Similarly, independent claim 24, as currently amended, recites a transmitter for an optical communication system comprising an electro-absorption modulator including a semiconductor layer having a material composition that is chosen so that a transmission response of the modulator as a function of applied voltage shifts with an increasing operating temperature of the modulator so that the semiconductor layer is substantially transparent to light propagating through the semiconductor layer when a substantially zero or a reverse bias voltage is applied across the semiconductor layer at operating temperatures of the electro-absorption modulator that are substantially greater than 25 degrees Celsius.

Paragraph [0041] of the present specification does not teach an optical communication system comprising an electro-absorption modulator including a semiconductor layer having a material composition that is chosen so that a transmission response of the modulator as a function of applied voltage shifts with an increasing operating temperature as claimed in independent claim 24. Therefore, the Applicants submit that independent claim 24 is allowable over the description of the prior art in the present specification. The Applicants also submit that dependent claims 25-28 are allowable as depending upon an allowable base claim.

Similarly, independent claim 29, as currently amended, recites a method of modulating light comprising propagating light through a semiconductor layer having a transmission response

Amendment and Response
Applicant: Krasulick, et al.
Serial No.: 10/005,065
Page 17 of 18

as a function of applied voltage that shifts with an increasing operating temperature of the semiconductor layer so that the semiconductor layer is substantially transparent to light propagating through the semiconductor layer when a substantially zero or a reverse bias voltage is applied across the semiconductor layer at operating temperatures of the electro-absorption modulator that are substantially greater than 25 degrees Celsius.

Paragraph [0041] of the present specification does not teach a method of modulating light comprising propagating light through a semiconductor layer as claimed in independent claim 29. Therefore, the Applicants submit that independent claim 29 is allowable over the description of the prior art in the present specification and the prior art of record. Applicants also submit that dependent claims 30-31 are allowable as depending upon an allowable base claim.

Similarly, independent claim 32, as currently amended, recites a method of tracking a temperature of an electro-absorption modulator to a temperature of a semiconductor laser comprising propagating the light through an electro-absorption modulator comprising a semiconductor layer having a material composition that is chosen so that a transmission response of the modulator as a function of applied voltage shifts with an increasing operating temperature of the modulator so that the semiconductor layer is substantially transparent to light propagating through the semiconductor layer when a substantially zero or a reverse bias voltage is applied across the semiconductor layer at operating temperatures of the electro-absorption modulator that are substantially greater than 25 degrees Celsius.

Paragraph [0041] of the present specification does not teach a method tracking a temperature of an electro-absorption modulator to a temperature of a semiconductor laser as claimed in independent claim 32. Therefore, the Applicants submit that independent claim 32 is allowable over the description of the prior art in the present specification.

In view of the above remarks, the Applicants respectfully submit that paragraph [0041] of the present specification does not describe each and every element of independent claims 1, 13, 24, 29 and 32, as currently amended, either expressly or inherently. Therefore, the Applicants submit that the present specification does not anticipate independent claims 1, 13, 24, 29 and 32, as currently amended, under 35 U.S.C. §102(b). Thus, the Applicants submit that independent claims 1, 13, 24, 29 and 32, as currently amended, are allowable. The Applicants also submit

Amendment and Response
Applicant: Krasulick, et al.
Serial No.: 10/005,065
Page 18 of 18

that dependent claims 2-12, 14-23, 25-28, 30-31 and 33 are allowable as depending from an allowable base claim.

CONCLUSION

Claims 1- 33 are currently pending in the present application. Claims 1, 4-9, 11, 13-14, 23-24, 28-31, and 32 are amended by the present Amendment. Claim 33 is added by the present Amendment. In view of the foregoing, reconsideration and allowance of all pending claims (i.e., claims 1-33) is respectfully requested.

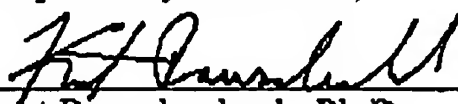
The Commissioner is hereby authorized to charge the statutory disclaimer fee, the additional claims fee, and any other proper fees to Attorney's Deposit Account No. 501211.

If, in the Examiner's opinion, a telephonic interview would expedite prosecution of the present application, the undersigned attorney would welcome the opportunity to discuss any outstanding issues, and to work with the Examiner toward placing the application in condition for allowance.

Date: July 30, 2004
Reg. No. 40,137

Tel. No.: (781) 271-1503
Fax No.: (781) 271-1527

Respectfully submitted,


Kurt Rauschenbach, Ph.D.
Attorney for Applicant
Rauschenbach Patent Law Group, LLC
Post Office Box 387
Bedford, MA 01730